2009

Calcasieu-Mermentau Basin

Characterization Report

Louisiana State Reservoir Priority and Development Program

moffatt & nichol

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2009

Calcasieu-Mermentau Basin

Characterization Report

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and Development Program

BASIN CHARACTERIZATION REPORT FOR THE CALCASIEU-MERMENTAU BASIN

The Louisiana Department of Transportation and Development (DOTD) is responsible for reviewing and prioritizing proposed reservoir projects for which State of Louisiana (State) funding is being sought, and then recommending projects to the State Legislature. To support reservoir project review, prioritization, and recommendation efforts, DOTD has prepared characterization reports of water resources conditions in each of the nine principal surface water basins in the State. These characterization reports provide an overview of water uses, needs, and concerns, and can be used by applicants for State funding, and by State agencies as they evaluate the applications. The basin characterization reports also contain extensive references that interested parties can use to find more information from Federal, State, and local agencies or other sources. The reports represent a "snapshot" of conditions in early 2009 (or when the references cited in the reports were published).

Based on available data, this basin characterization report provides an overview of the water uses, needs, and key water resources concerns for the Calcasieu-Mermentau Basin (CMB) (**Map 1**). Additional technical information on important issues may be provided in separate technical reports.

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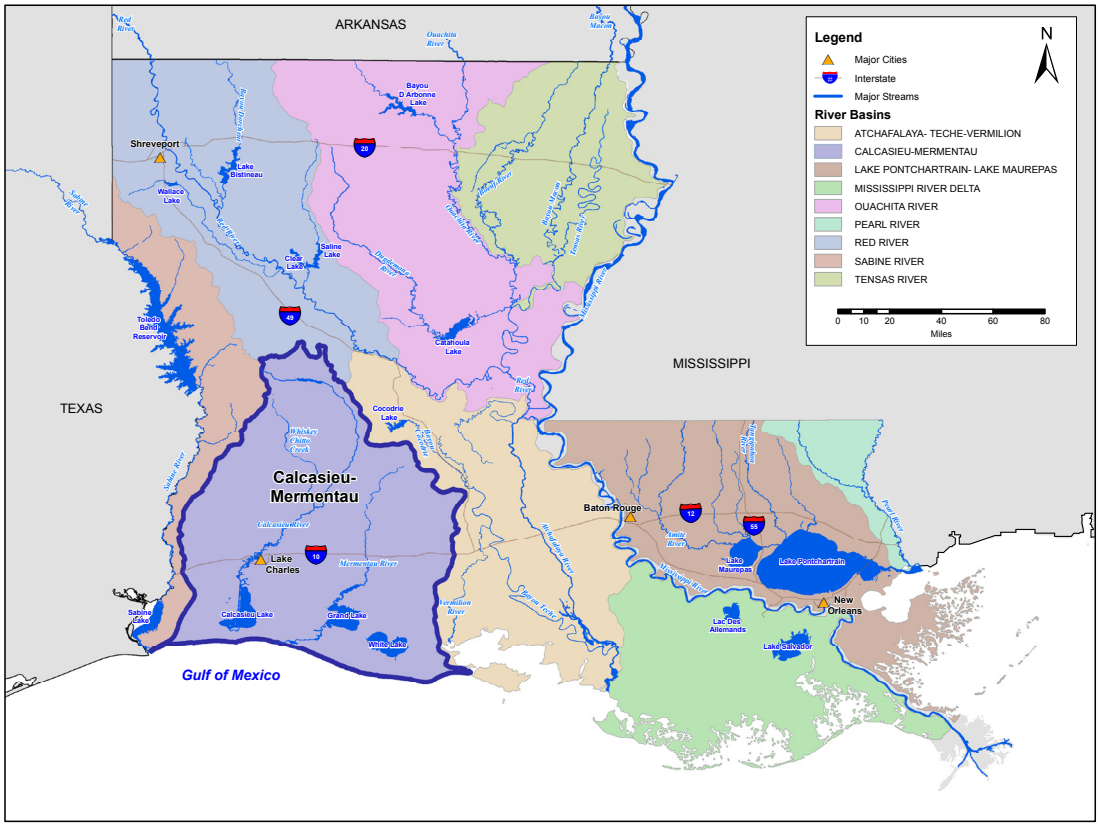
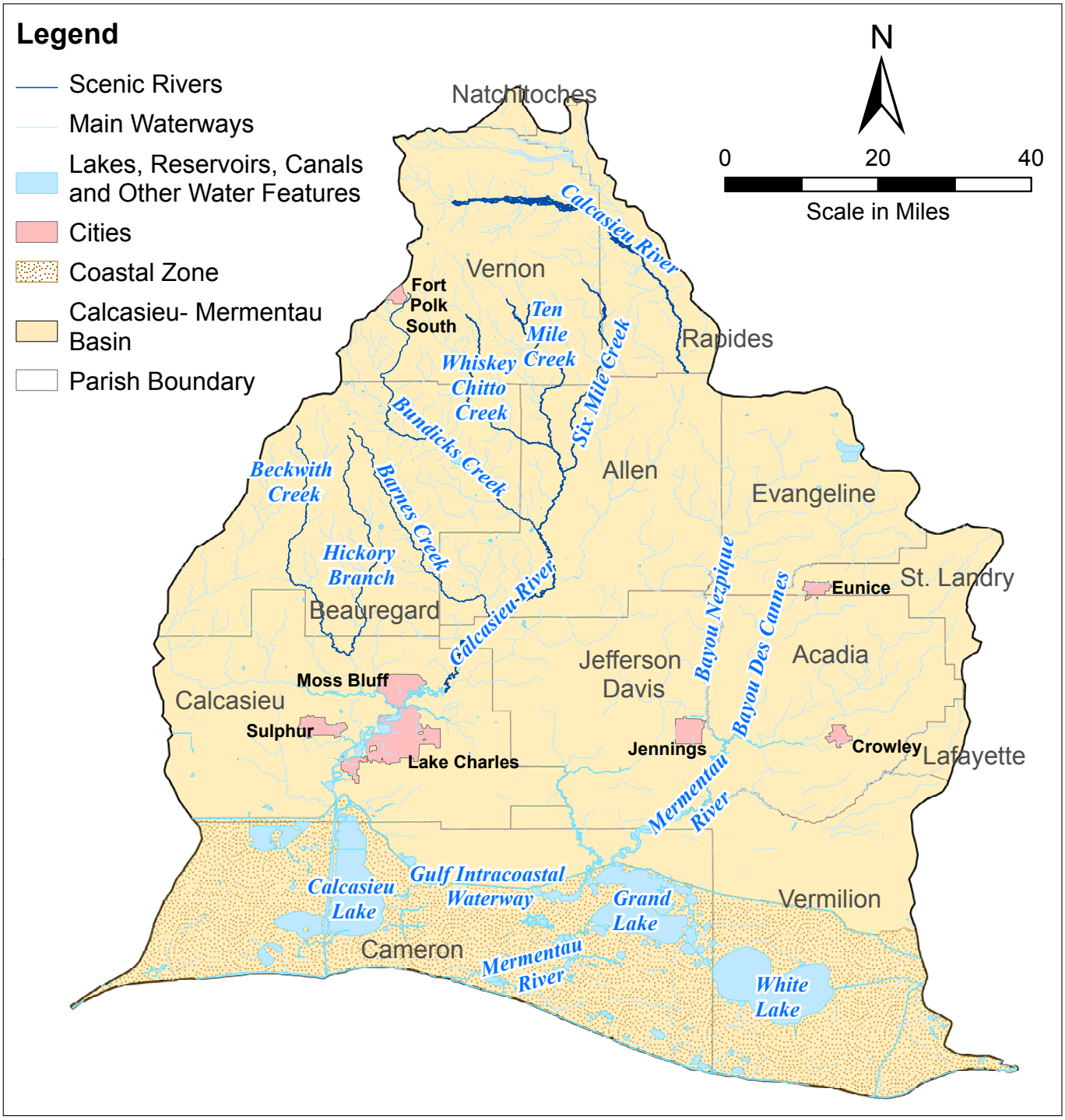


Map 1. Major Surface Water Basins of Louisiana[1]

BASIN OVERVIEW

The CMB is located in southwestern Louisiana and has an area of 8,017 square miles (see **Map 2**).[2] The CMB is bounded by the Red River Basin to the north, the Sabine River Basin to the west, the Atchafalaya-Teche-Vermilion Basin to the east, and the Gulf of Mexico to the south. The basin consists primarily of flat to gently sloping terraces. The southern CMB is in the Coastal Zone, as delineated by the Louisiana Department of Natural Resources (LDNR).



Map 2. Parishes, Main Waterways, and City Boundaries[3]

Thirteen parishes are either completely or partly encompassed by the CMB. Lake Charles is the largest city in the CMB. The estimated total population in the CMB in 2005 was 448,643. **Table 1** shows the 2005 population distribution in the CMB by parish. **Figure 1** shows the change in basin population from 1960 to 2005. The population has increased steadily from 1960 to present. Continued growth at the historical rate will likely increase demand for high quality potable water sources.

Principal economic activities in the CMB include agriculture- and defense-related businesses.[5] The primary future economic growth areas for this basin are not clearly defined.

Table 1. CMB Population by Parish in 2005[4]

Parish	Population
Acadia	58,804
Allen	24,890
Beauregard*	30,608
Calcasieu*	183,182
Cameron*	9,540
Evangeline*	30,760
Jefferson Davis	30,930
Lafayette*	7,021
Natchitoches*	209
Rapides*	5,419
St. Landry*	32,910
Vermilion*	16,974
Vernon*	17,396
TOTAL	448,643

*Parish is located in more than one basin, but at least five percent of parish area is within the CMB; population estimate is for the area within the CMB.

CMB=Calcasieu-Mermentau Basin

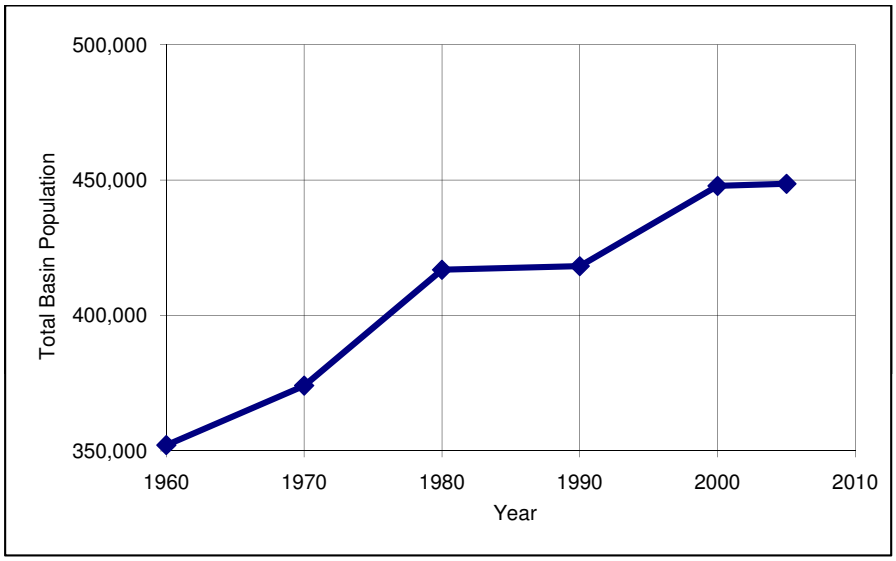


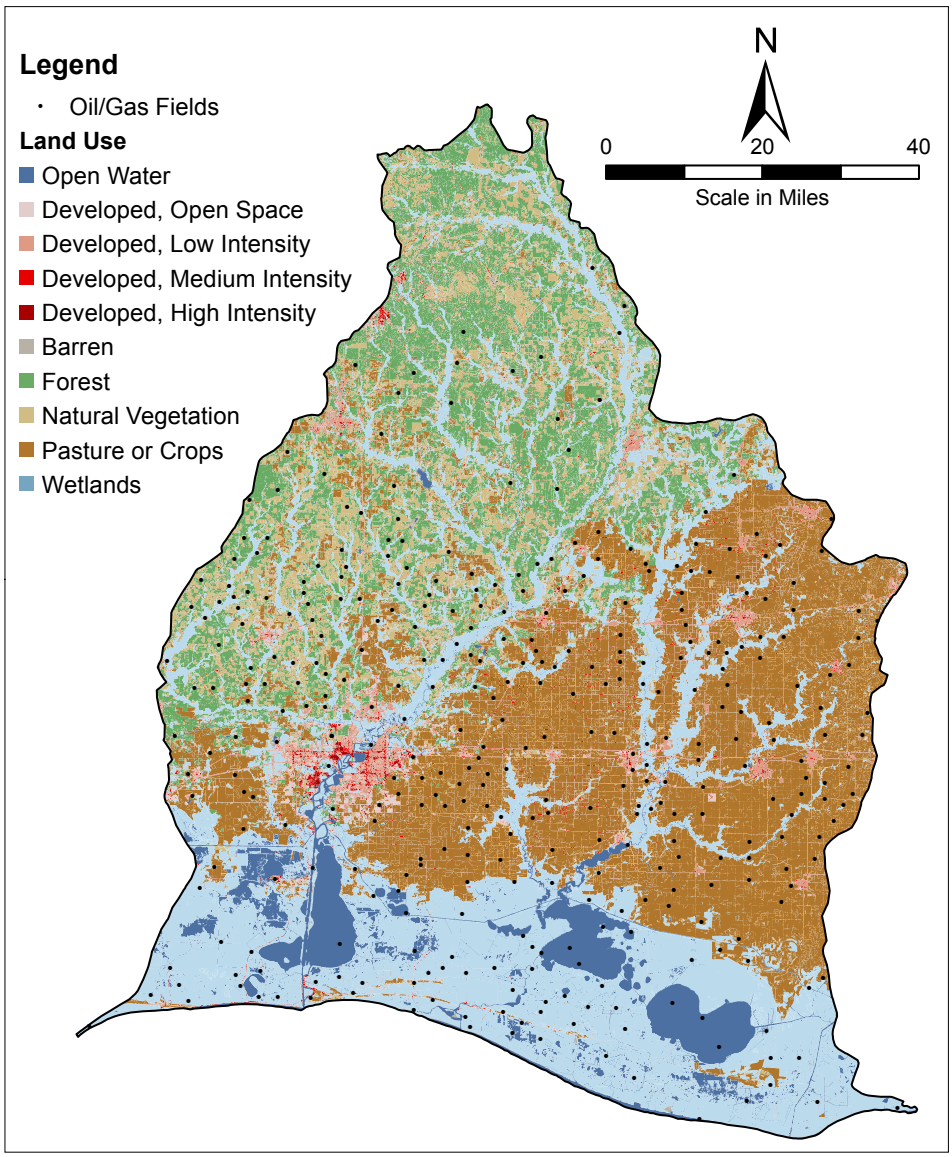
Figure 1. Historical CMB Population

LAND USE AND LEGAL ENTITIES

Map 3 shows 2003 land uses in the CMB. Principal land uses are agriculture and forestry. Irrigation is common in the CMB, particularly for rice cultivation, and areas of agricultural land use as shown in **Map 3** may indicate areas with a demand for irrigation water supply. In the vicinity of Lake Charles, substantial areas are developed for residential and industrial uses, but the southern CMB is dominated by wetlands and open water. Economic modeling for 1992 to 2020 indicates that forestry land uses may decrease slightly in the CMB in the future, and that negligible change in urban land uses is expected.[6]

The CMB contains a substantial amount of land considered Prime Farmland by the Federal Natural Resources Conservation Service (NRCS).[8] The NRCS must be contacted regarding proposed irreversible conversion of any Prime Farmland for reservoir construction and water storage. Many oil and gas fields have been drilled throughout the basin (Map 3). Oil and gas drilling can require large amounts of water for extraction, which then needs to be disposed, either to surface water or groundwater. Existing oil and gas infrastructure and mineral rights holdings may present potential impediments to development of surface water resources.

Table 2 lists legal entities in the CMB that may affect or be affected by water resources development.



Map 3. ORB Land Uses in 2003[7]

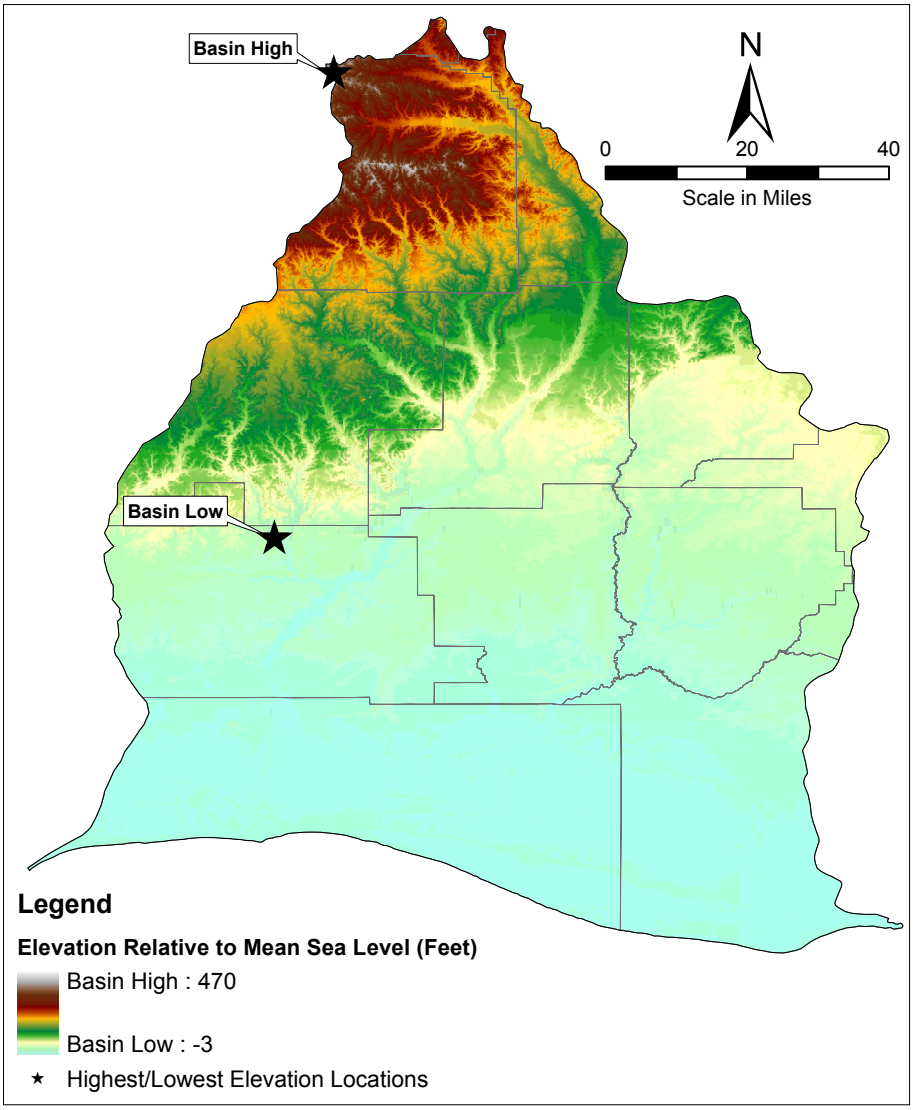
Table 2. ORB Water Resources Legal Entities

Special District	Responsibilities
Coordinating and Development Corporation	Planning and development in Arkansas-Louisiana-Texas region
Kisatchie-Delta Regional Planning and Development District	Planning and development in central Louisiana
North Delta Regional Planning and Development District	Planning and development in northeast Louisiana
Red River Waterway District	Maintaining navigable waterways in the Red River
Sparta Ground Water Conservation District	Studying ways to put Sparta Aquifer groundwater to the highest beneficial use in terms of public welfare

ORB=Ouachita River Basin

PHYSIOGRAPHIC AND CLIMATIC INFORMATION

Map 4 shows general basin topography. The CMB comprises three major physiographic regions: Pine Hills, Prairies, and Coastal Marshes. The northern CMB is dominated by the Pine Hills physiographic region, which is characterized by undulating hills covered by extensive pine and hardwood forests. The central CMB is considered a part of the Prairie physiographic region, a region characterized by surface elevations ranging from 20 to 30 feet above mean sea level and few trees, except along streams. The southernmost CMB is part of the flat Coastal Marshes physiographic region, which is subject to tidal flooding from the Gulf of Mexico. Along the eastern boundary of the CMB, the terrain is a relatively flat alluvial plain. The lowest elevation within the CMB is 3 feet below mean sea level, located in Calcasieu Parish. The highest point, 470 feet above mean sea level, is located in Vernon Parish, on the northern basin boundary.



Map 4. OCMB Topography[9]

Soils in most of the basin are characterized as loamy and silty deposits, although soils in the southern coastal area are characterized as saline organic and mineral coastal deposits.[10]

Average annual rainfall throughout the CMB varies from 60 to 64 inches per year, increasing from west to east across the basin.[11] **Figure 2** shows historical annual precipitation at Lake Charles, which varies between about 35 and 85 inches per year, with a historical average of about 56 inches per year. Although rainfall and the resulting runoff are plentiful in the CMB, the historical record shows that extended dry periods have occurred (e.g., 1962 to 1966) that stress surface water and groundwater supplies. Average annual temperature generally increases from north to south across the basin, from 65 to 68 degrees Fahrenheit (oF).[11] Average high temperature at Lake Charles during the warmest months, July and August, is 91°F; average low temperature in the coldest month, January, is 41°F.

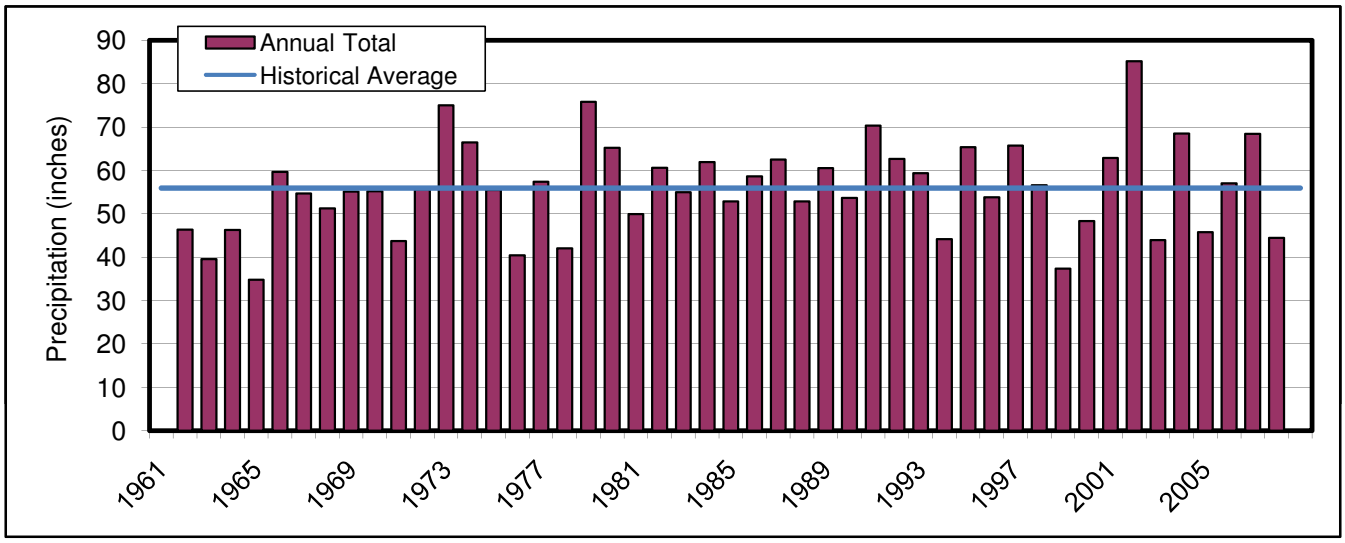


Figure 2. Historical Annual Precipitation at Lake Charles[11]

WATER USE

Water use in the CMB is summarized in **Table 3** by sector, water type, surface water body, and parish, as reported for 2005. **Table 3** is based on water withdrawal data, which may be greater than total water consumptive use. For example, the power generation sector withdraws water for both steam generation and cooling, uses that do not entirely consume withdrawn water, and allow a large percentage of the water to be returned to a waterway. Similarly, water withdrawn for irrigation is not entirely consumed by crops, allowing a percentage of the water to be returned to a waterway. In 2005, total water use was just over 940 million gallons per day (mgd). CMB water demands in 2005 were met by a combination of surface water and groundwater. The industrial sector used the largest amount of surface water, almost 185 mgd. Nearly all industrial use in Calcasieu Parish was for chemical manufacturing (137 mgd) and petroleum refining (43 mgd). Rice irrigation and aquaculture also used substantial amounts of surface water in 2005. Surface water uses are supplied primarily by the Calcasieu River, the Sabine River Diversion Canal, and Bayou Queue de Tortue.

Because groundwater use is not reported by surface water basin, individual parish groundwater use was estimated by multiplying total parish groundwater use by the percentage of total parish population within the CMB **(Table 3)**; actual groundwater use by parish may differ from this estimation. Rice irrigation used the largest amount

of groundwater in 2005, 349 mgd. Aquaculture extracted the second-largest amount of groundwater, nearly 85 mgd. The third-largest groundwater user, industry, was concentrated in Calcasieu and Beauregard parishes, with 43 and 20 mgd of use, respectively. In Calcasieu Parish, about 75 percent of the groundwater was used for chemical manufacturing, and the remainder was used for petroleum refining. In Beauregard Parish, the paper products industry dominated industrial use of groundwater. A substantial amount of groundwater, nearly 56 mgd, was also used for public supply in 2005. Most municipal water suppliers used less than 2 mgd of groundwater, although the following supplies reported groundwater use equaling or exceeding 2 mgd:

- Crowley Water System – 2 mgd
- Lake Charles Water System – 13 mgd
- Moss Bluff Water District 1 – 2 mgd
- Opelousas Water System – 5 mgd
- Sulphur Water System – 4 mgd

Figure 3 shows trends in surface water and groundwater use in the CMB at 5-year intervals from 1990. Rice irrigation and aquaculture uses of both surface water and groundwater fluctuated during this 15-year period, which could be due to differences in precipitation and runoff during this time. Industrial use of surface water also fluctuated during this period; groundwater use for public supply increased from 47 mgd to 55.9 mgd during the same time.

Table 3. CMB Water Use in 2005[12]

Sector	Surface Water (mgd)	Groundwater (mgd)
Aquaculture	21.9	84.7
General irrigation	0.4	1.9
Industry	184.9	65.7
Livestock	1.0	0.9
Power generation	14.0	1.4
Public supply	0.4	55.9
Rice irrigation	154.1	349.0
Rural domestic	0.0	6.7
TOTAL	376.8	566.2

Surface Water Body	Use (mgd)
Bayou Chene	4.4
Bayou Des Cannes	1.2
Bayou Lacassine	4.4
Bayou Marron	1.2
Bayou Nezpique	2.4
Bayou Plaquemine Brusly	12.2
Bayou Queue de Tortue	47.8
Calcasieu River	146.9
Gulf Intracoastal Waterway	2.0
Lyons Point Gully	6.7
Mermentau River	20.0
Miller Lake	1.1
Sabine River Diversion Canal	52.3
Other (not listed)	74.2
TOTAL	376.8

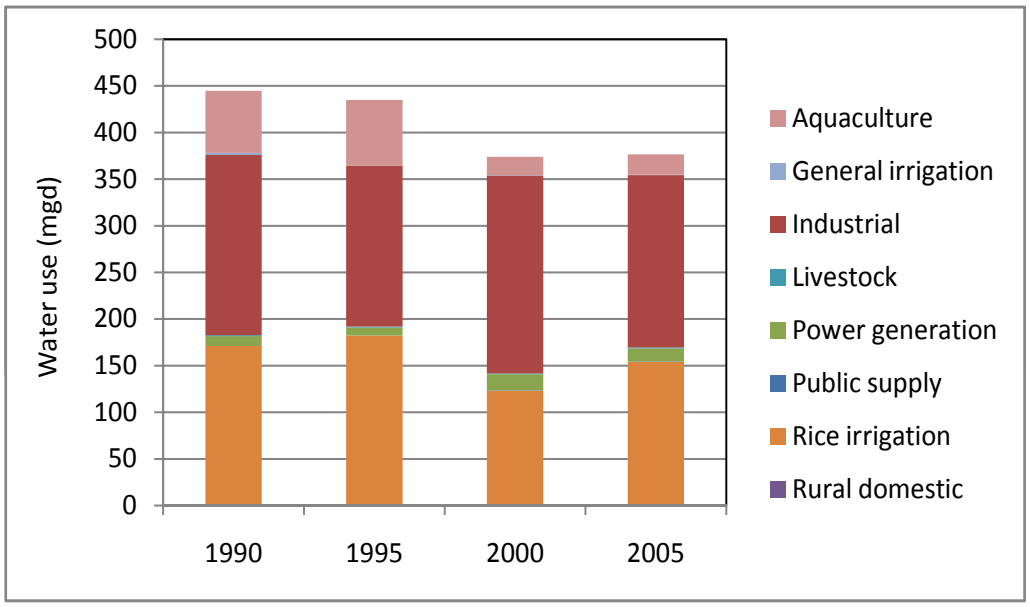
Sector	Surface Water (mgd)	Groundwater* (mgd)
Acadia	44.6	168.5
Allen	2.5	26.8
Beauregard	0.1	27.2
Calcasieu	202.8	89.1
Cameron	21.2	6.0
Evangeline	8.7	63.5
Jefferson Davis	15.9	151.8
Lafayette	1.2	0.0
St. Landry	4.8	18.6
Vermilion	75.1	12.5
Vernon	0.0	2.2
TOTAL	376.9	566.2
Rapides	0.0	12.6
Union	0.2	5.5
Winn	0.08	3.0
TOTAL	159.4	141.7

*Groundwater use estimated for parishes with at least 5 percent of their population within the CMB.

CMB=Calcasieu-Mermentau Basin

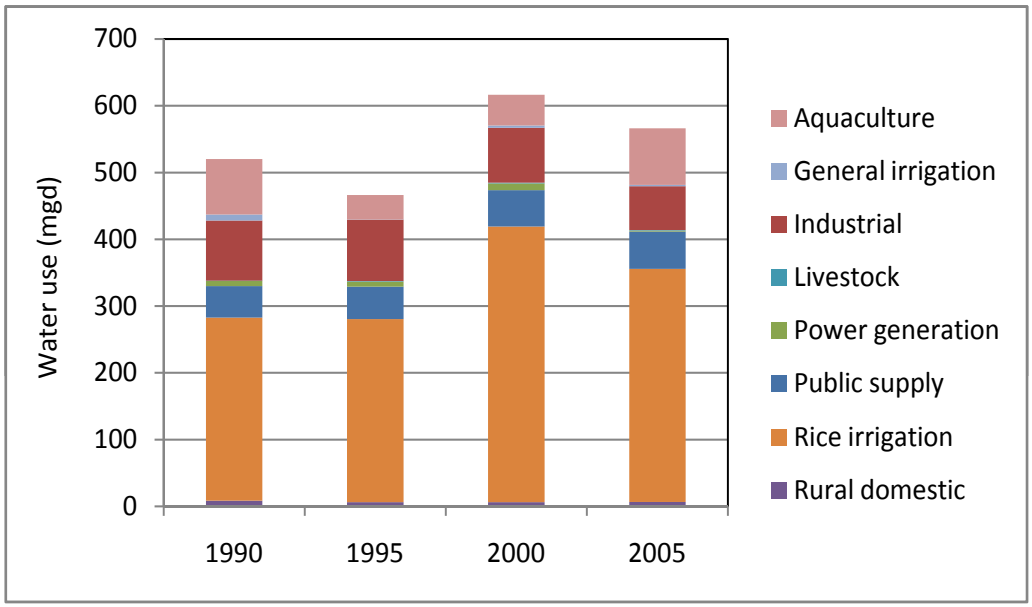
mgd=million gallons per day

Recent Historical Surface Water Use



mgd=million gallons per day

Recent Historical Groundwater Use



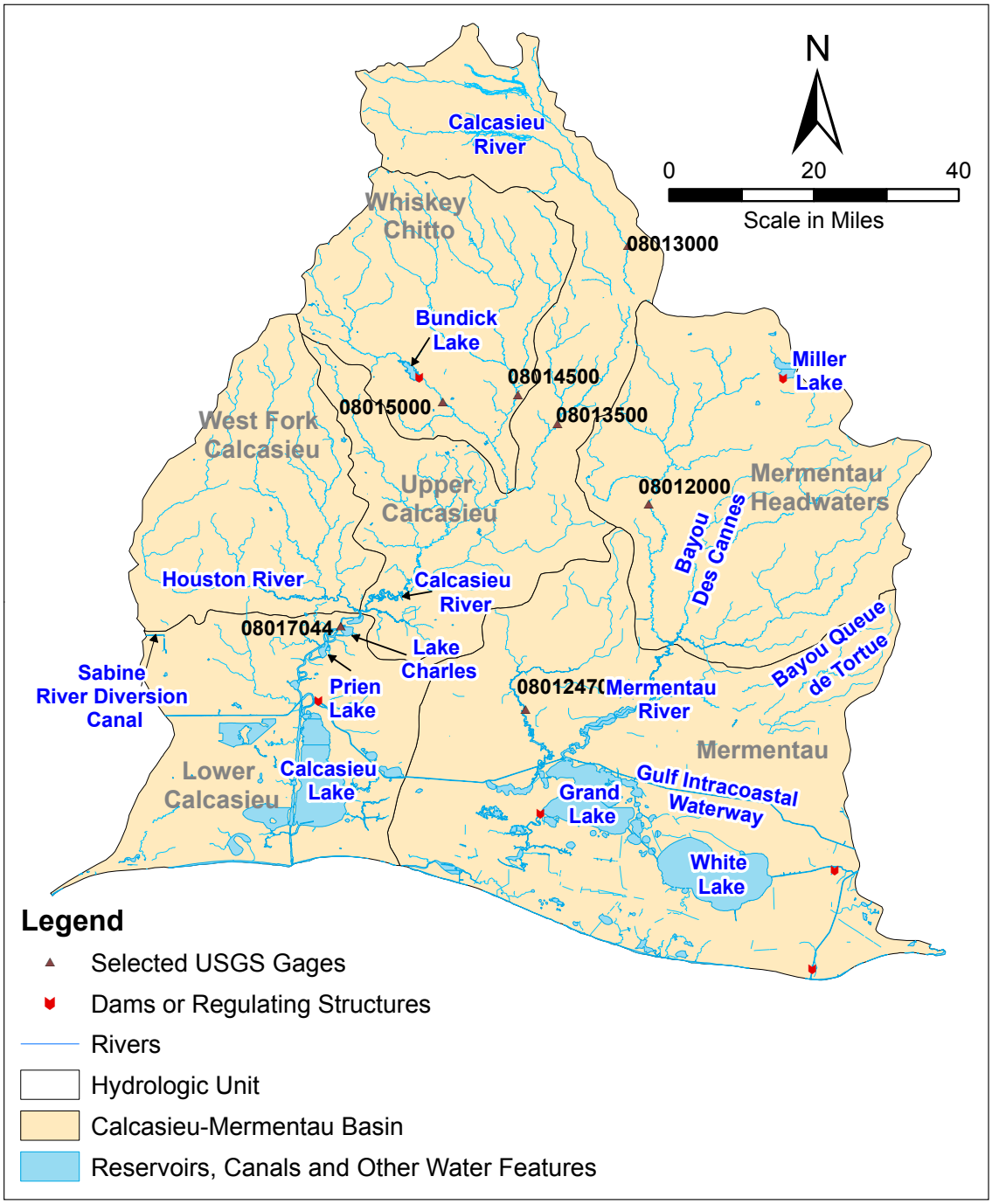
mgd=million gallons per day

Figure 3. Trends in Water Use in CMB by Sector[13]

Per capita water use in 2005 (based on reported rural domestic and public supply uses by parish, and estimated parish population) for CMB parishes varied from 124 gallons per capita (person) per day (gpcd) in St. Landry Parish to 229 gpcd in Cameron Parish.[12] Continued population growth at the historical rate will likely increase demand for high-quality water supplies for both public supply and industrial uses. However, most water use in the CMB is for agricultural purposes, and future total water use trends will likely be dominated by the activities in this sector. Agricultural water use in any given year depends on weather and crops grown; crop selection is based largely in response to market conditions and available government subsidies. Therefore, it is difficult to predict likely future trends in agricultural water use in the CMB.

SURFACE WATER

Primary surface water features in the CMB include streams, bayous, rivers, reservoirs, and canals, as shown in **Map 5. Map 5** also shows the six subwatersheds, or hydrologic units, delineated in the CMB by the U.S. Geological Survey (USGS), and stream gages referenced in this report. The CMB does not receive substantial freshwater inflow from outside the basin, with the exception of the Sabine River Diversion Canal, which flows from the Sabine River, west of the CMB, to Lake Charles.



Map 5. Surface Water Features[14]

Extensive surface water and groundwater data for Louisiana, including gaged streamflows and lake levels, are available through the USGS National Water Information System (NWIS) Web site.[15] Streamflow statistics for selected CMB gages with long-term streamflow records are summarized in **Table 4**. However, some gages on major sreams in the CMB, such as on the Mermentau River at Mermentau, are affected by wind and/or tides. These phenomena can cause frequent reverse flow, making typical streamflow statistics difficult to report.

Table 4. Historical Streamflow Statistics for Selected Gages[16]

Stream Gage Informaiton			Period of Record Streamflow Statistics (cfs)				Percent of Streamflows Exceed (cfs)		
				Instantaneous					
Location (USGS Gage)	Drainage Area (mi²)	Period of Record	Annual Average	Max. Peak (date)	Low Flow (date)	7Q10[17]	10	50	90
Bayou Nezpique near Basile, LA (08012000)	527	1938 – present	836	35,800 (5/20/53)	0.10 (6/29/48)	0.7	2,580	167	12
Calcasieu River near Glenmora, LA (08013000)	499	1943 – present	777	59,500 (5/19/53)	15 (several)	19	2,100	166	31
Whiskey Chitto Creek near Oberlin, LA (08014500)	510	1939 – present	820	144,000 (5/18/53)	86 (9/6/00)	116	1,800	364	162
Calcasieu River near Oberlin, LA (08013500)	753	1922 – present	1,143	72,800 (5/19/53)	18 (9/6/00)	34	2,960	317	59
Calcasieu River near Kinder, LA (08015500)	1,700	1922 – present	2,629	182,000 (5/19/53)	127 (11/12/05)	216	6,070	1,040	329

7Q10=7-day low flow with 10-year recurrence
Avg.=average
cfs=cubic foot per second
LA=Louisiana
Max.=maximum
mi2=square miles
USGS=U.S. Geological Survey

Statistics summarized in **Table 4** can be useful for various purposes. The 7-day low flow with a recurrence interval of 10 years (7Q10) is the statistic used to calculate available dilution in surface water discharge permits. Water bodies with low 7Q10 flows, less than a few cubic feet per second (cfs), typically have extended periods of low flows. Bayou Nezpique is the only CMB stream gage summarized in **Table 4** that has extended low flows. Peak flows, including the maximum instantaneous discharge and the streamflow exceeded by only 10 percent of flows, are useful for characterizing flooding and high-flow conditions in a stream.

Figure 4 shows historical monthly average flows for gages with available data located on major streams. Flows at these gages show a seasonal runoff pattern, with highest flows occurring in winter and spring, and lowest flows occurring in late summer and early fall. However, even in fall, monthly average flows remain above 100 cfs at all gages summarized.

The CMB contains 781 miles of streams designated under Louisiana's Natural and Scenic River System (shown in **Map 2**). These waterways are protected by a permit process and certain prohibitions. against channelization, impoundment construction, and channel realignment.[19]

Siltation and sedimentation of natural, unmodified streams is a problem in the CMB. This has been attributed to the straightening and enlargement of particular waterways and canals to facilitate general navigation, and for use by the petroleum industry. Such modifications cause the majority of streamflow to be routed away from natural channels, resulting in sediment buildup.[2]

Published characteristics of major lakes and reservoirs in the CMB are summarized in **Table 5**. Considerable freshwater is stored in several CMB lakes, including White Lake, Grand Lake, and Calcasieu Lake.[2] The U.S. Army Corps of Engineers (USACE) operates Grand and White lakes for multiple purposes.

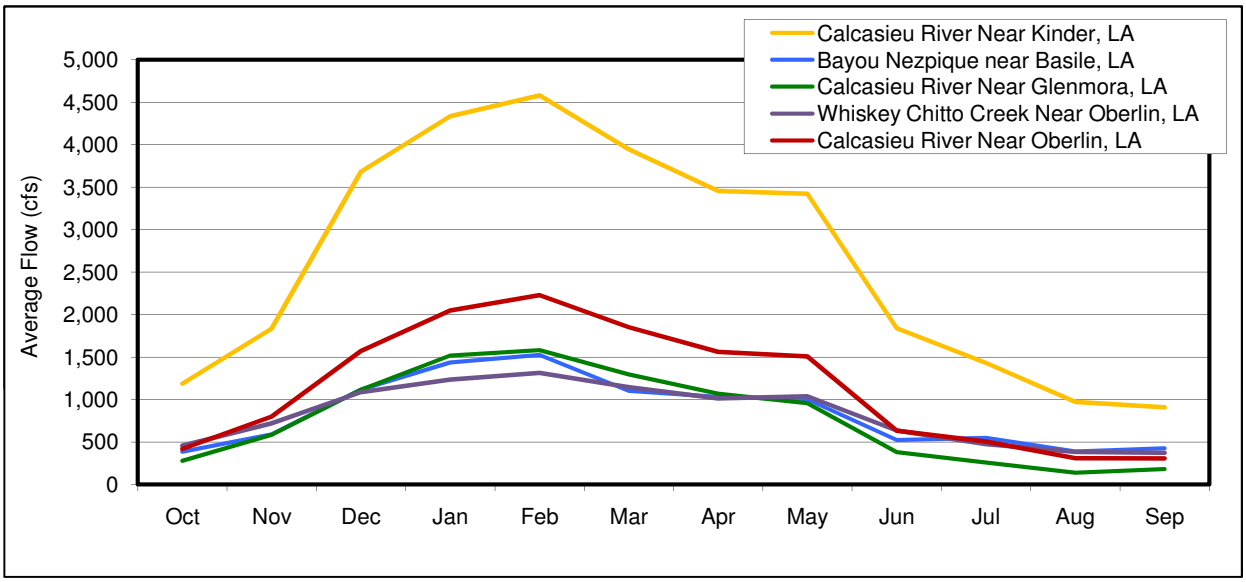


Figure 4. Historical Monthly Average Streamflow for Selected Gages[18]

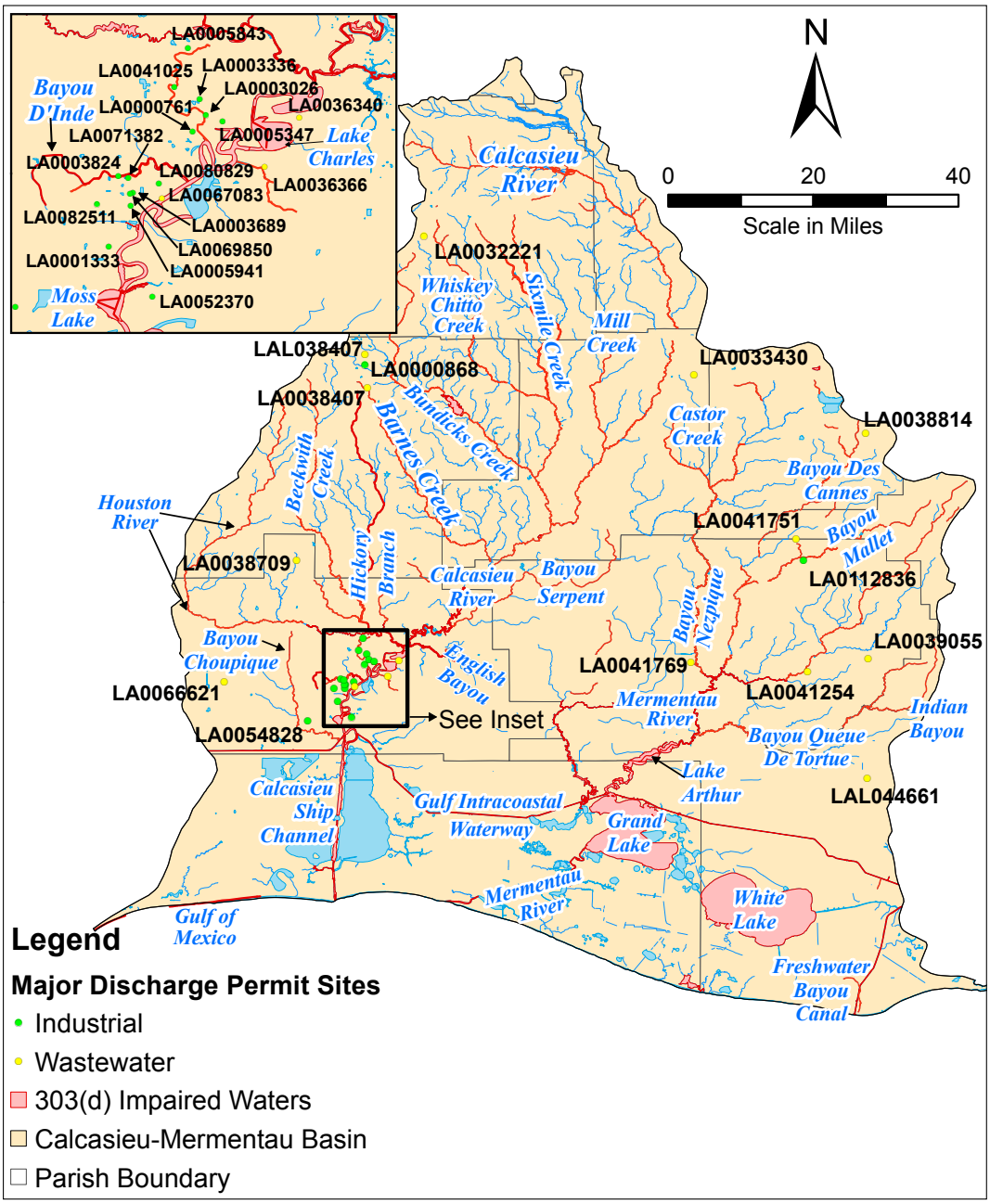
Table 5. Characteristics of Major Lakes and Reservoirs in the CMB[20]

Name	Surface Area (acres)	Volume (acre-feet)
Bundicks Lake (reservoir)	1,747	9,200
Calcasieu Lake	42,880	210,000
Grand Lake	32,000	147,000
Lake Charles	1,114	9,650
Miller Lake	3,000	10,000
Prien Lake	980	5,320
White Lake	51,840	234,000
Catahoula Lake	15,664	NA

CMB=Calcasieu-Mermentau Basin

Surface Water Quality

The 303(d) list (named after Section 303(d) of the Federal Clean Water Act) included in Louisiana's Integrated Water Quality Report provides an overview of surface water locations where water quality standards are not met.[21] In these cases, designated uses of water bodies, such as fish and wildlife propagation, recreation, or drinking water supply may be impaired. Stream and lake sub-segments on the 2006 303(d) list for the CMB are shown in **Map 6**. Many major lakes, rivers, and bayous in the CMB are considered impaired. **Table 6** summarizes the number of stream and lake sub-segments in the CMB that are on the 2006 303(d) list, and identifies impaired uses and parameters causing the impairment. Fish and wildlife propagation is the most frequently affected use in the CMB. Design of new reservoirs, either impounding impaired waters or discharging to impaired waters, would need to consider these water quality challenges and any ongoing or planned water quality improvement projects.



Map 6. ORB Impaired Waters from 303(d) List and Major Permitted Discharge Sites[22]

Table 6. Summary of CMB Surface Water Quality Impairments[21]

Impaired Use	Sub-segments
Fish and wildlife propagation	172
Primary contact recreation	15
Outstanding natural resource	3
Secondary contact recreation	2
Oyster propagation	2
Drinking water supply	2

FWP = fish and wildlife propagation
ONR = outstanding natural resource
CMB = Calcasieu-Mermentau Basin
OYS = Oyster propagation
PCR = primary contact recreation (swimming)
SCR = secondary contact recreation (boating)

Parameter Causing Impairment (affected use)	Sub-segments
Dissolved Oxygen (FWP)	38
Nutrients (FWP)	30
Turbidity (FWP and ONR)	18
Hydrocarbons (FWP, PCR, and SCR)	16
Total Suspended Solids (FWP and ONR)	15
Fecal Coliform (OYS, PCR, and SCR)	13
Mercury (FWP)	13
Sedimentation (FWP)	12
Total Ammonia (FWP)	8
Insecticides (FWP)	8
Lead (FWP)	7
Total Dissolved Solids (FWP)	6
Carbofuran (FWP)	3
Low pH (FWP)	3
Chloride (FWR)	2
DDT (FWP)	1
Sulfate (FWP)	1
Atrazine (herbicide) (FWP)	1
Non-native aquatic plants (FWP)	1
Oil and grease (FWP)	1

Low dissolved oxygen, which affects fish and wildlife production, is a very common impairment in the CMB. This impairment is variously caused by natural conditions, municipal wastewater discharge, and/or discharge of agricultural drainage water from irrigated land. Nutrient impairments likely have a similar range of sources. Fecal coliform impairments have several different potential sources, including sewage discharge in unsewered areas, and wildlife other than waterfowl.

Elevated total suspended solids and turbidity are also common impairments in the CMB. In many cases, these impairments are related to erosion resulting from agricultural activities.[2] In other cases, such as in the Gulf Intracoastal Waterway (GIWW) and English Bayou, these impairments are attributed to flow alteration.

Industrial point source discharges, presumably related to oil and gas production, are the likely source of hydrocarbon impairments in the CMB. Approximately 21 miles of the Calcasieu River, as well as other estuarine bayous, are impaired by hydrocarbons.

Over 400 miles of streams in the CMB are considered impaired for mercury in fish tissue, leading to consumption advisories. The Louisiana Department of Environmental Quality (LDEQ) has been investigating the mercury problem throughout the State since fish tissue data for the Ouachita River first resulted in a fish consumption advisory in 1992.[23]

Saltwater intrusion is a concern in the CMB because of the basin's proximity to the ocean.[2] Former freshwater marsh areas around Calcasieu Lake and the Fresh Water Bayou Navigation Canal have gradually become brackish because of saltwater intrusion. The Calcasieu River and other streams south of Lake Charles are also affected by saltwater intrusion. This intrusion is attributed to both industrialization of the surrounding area and operation of water control structures.

Permitted Surface Water Discharges

LDEQ issues permits for discharges of municipal and industrial wastewater. Permitted discharges classified as "major" by the U.S. Environmental Protection Agency (USEPA) (generally those with flow greater than 1 mgd) are shown in **Map 6**. Major municipal wastewater discharges are summarized in **Table 7** and major industrial permitted discharges in **Table 8**. Additional information on all dischargers in Louisiana can be obtained from LDEQ through their public records request process.[24]

The City of Lake Charles's wastewater treatment plant (WWTP) A has the largest municipal discharge at 6.7 mgd, followed by the City of Sulphur's WWTP at 6 mgd. Eighteen major permitted industrial dischargers are located in the CMB, with a total permitted discharge of 175 mgd. As shown in **Map 5**, most dischargers are located along the Calcasieu River upstream from the GIWW, in the Lake Charles area. Industrial dischargers include power facilities, industrial chemical facilities, and refineries. The largest permitted industrial discharge is the Citgo Refinery, with permitted flow exceeding 63 mgd. Discharge permit conditions are based on receiving-water low-flow quantity and quality. Future water development projects that change low-flow quantity or quality at the discharge location could affect the ability of permit holders to comply with permit conditions.

Table 7. Major Municipal Wastewater Discharge Permits in the ORB[25]

Discharger	Permit Number	Permitted Flow (mgd)	Receiving Water	Parish
Crowley, City of	LA0041254	2.5	Drainage Ditch/Bayou Plaquemine	Acadia
Dequincy, City of	LA0038709	1.1	Buxton Creek	Calcasieu
DeRidder, City of	LA0038407	1.9	Barnes Creek/Calcasieu River	Beauregard
Eunice, City of	LA0041751	2	Bayou Mallett	St. Landry
Fort Polk	LA0032221	0.9	Drakes CK-Ouiska Chitto-Calcasieu	Vernon
Jennings , City of	LA0041769	2.5	Bayou Nezpique	Jefferson Davis
Kaplan, City of	LAL044661	0.6	NA	Vermilion
Lake Charles, City of (WWTP A)	LA0036340	6.7	Calcasieu River	Calcasieu
Lake Charles, City of (WWTPs B and C)	LA0036366	4	Calcasieu Bayou	Calcasieu
Oakdale, City of	LA0033430	0.8	Beaver Creek/Boggy Creek/East Fork	Allen
Rayne, City of	LA0039055	1.6	Bayou Blanc	Acadia
Sulphur, City of	LA0067083	6	Calcasieu River	Calcasieu
Ville Platte, City of	LA0038814	1	Bayou Joe Marcel	Evangeline
Vinton, Town of	LA0066621	4.6	Cooney Gully-Vinton Drainage Canal	Calcasieu

Information presented in this table is directly from USEPA (2009a). For detailed explanation, this reference should be consulted.
CMB=Calcasieu-Mermentau Basin
mgd=million gallons per day
NA=not available
WWTP=wastewater treatment plant

Table 8. Major Industrial Discharge Permits in the CMB[25]

Discharger	Permit Number	Permitted Flow (mgd)	Receiving Water	Type	Parish
Acadia Power Station	LA0112836	7.9	Bayou Mallet	Electric services	Acadia
Basell USA Incorporated	LA0003689	3.5	Calcasieu River	Plastics and other	Calcasieu
Calcasieu Refining Company	LA0052370	9.9	Calcasieu River	Petroleum refining	Calcasieu
Certainteed Products Corp	LA0041025	0.5	Calcasieu River	Plastics	Calcasieu
Chemical Waste Management	LA0054828	21.9	Bayou Choupique	Sanitary services	Calcasieu
Citgo Lake Charles Refinery	LA0005941	63.1	Calcasieu River and Bayou D'Inde	Petroleum refining	Calcasieu
Condea Vista Company Lake Charles Chemical Complex	LA0003336	4.5	Calcasieu River and Bayou Verdine	Industrial organic chemicals	Calcasieu
Conocophillips – Lake Charles Refinery	LA0003026	5.4	Calcasieu River and Bayou Verdine	Petroleum refining	Calcasieu
Entergy Roy S. Nelson Plant	LA0005843	8.3	Houston River	Electric services	Calcasieu
Equistar Chemicals Lake Charles Plant	LA0069850	9.2	Bayou D'Inde	Industrial organic chemicals	Calcasieu
Firestone Synthetic Rubber and Latex CO	LA0003824	3.5	Calcasieu River via Bayou D'Inde	Synthetic rubber	Calcasieu
Louisiana Pigment CO – Titanium Dioxide Plant	LA0080829	2.1	Calcasieu Ship Channel	Industrial inorganic chemicals	Calcasieu
Lyondell Chemical Worldwide Incorporated	LA0005347	2.1	Calcasieu River and Bayou Verdine	Industrial organic chemicals	Calcasieu
Meadwestvaco South Carolina LLC – Specialty Chemicals Division	LA0000868	0.6	Palmetto Creek	Gum and wood chemicals	Beauregard
Pilgrim's Pride Corporation	LA0054178	6.1	Unknown (listed as 1023); not shown on Map 6	Poultry slaughtering and process	Natchitoches
PPG Industries INC – Lake Charles Complex	LA0000761	10.1	Bayou D'Inde and Bayou Verdine	Industrial organic chemicals	Calcasieu
W.R. Grace and CO – CONN. Davidson Catalysts	LA0001333	3.0	Young's Bayou and Calcasieu River	Industrial inorganic chemicals	Calcasieu
Westlake Petrochemicals LP	LA0082511	17.9	Calcasieu River	Industrial organic chemicals	Calcasieu
Westlake Polymers Corporation	LA0071382	1.3	Bayou D'Inde and Calcasieu River	Plastics	Calcasieu

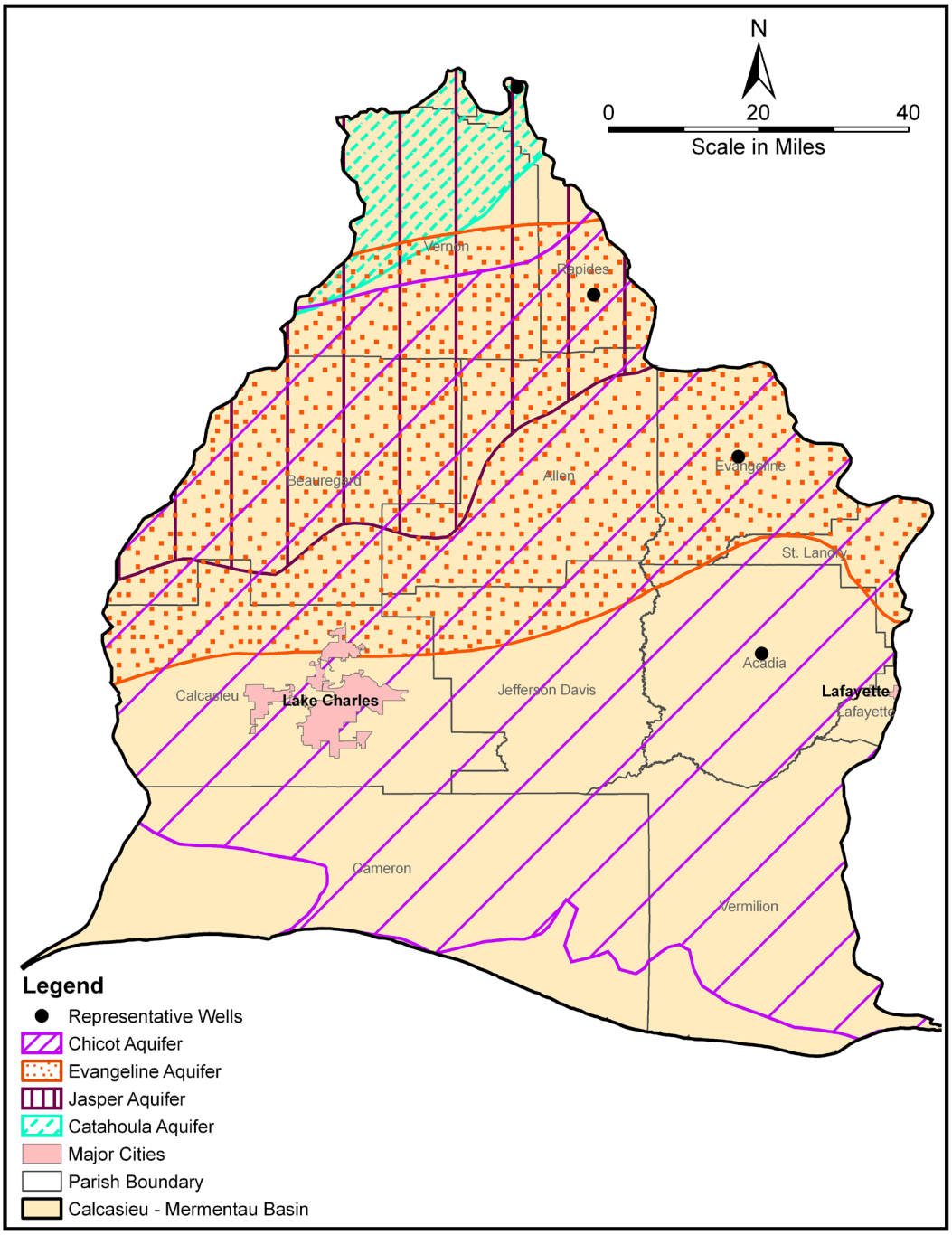
Information presented in this table is directly from USEPA (2009a). For detailed explanation, this reference should be consulted.
CMB=Calcasieu-Mermentau Basin
LLC=Limited Liability Company
mgd=million gallons per day

GROUNDWATER

The State has registered about 4,400 groundwater wells in the CMB.[15] The following major aquifers underlie portions of the CMB:

- Chicot Aquifer
- Evangeline Aquifer
- Jasper Aquifer
- Catahoula Aquifer

In addition, shallow alluvial aquifers are present in the CMB. Major aquifers in the CMB are shown in **Map 7** and their characteristics are summarized in **Table 9**. Aquifer areas overlap because the aquifers occur at different depths. **Figure 5** shows historical groundwater levels in the most heavily used aquifers in the CMB.



Map 7. Spatial Extents of Major CMB Aquifers[26]

Table 9. Overview of CMB Major Aquifer Characteristics[2]

Aquifer	Range of Thickness of Freshwater Interval (feet)	Typical Well Yields (gpm)	Hydraulic Conductivity (feet/day)	Specific Capacity (gal/min/ft of drawdown)	Depth to Groundwater in 2005 (feet)[15]
Chicot	50 – 1,050	500 – 2,500 4,000 (large capacity)	40 – 220	2 – 35	30 – 120
Evangeline	50 – 1,900	200 – 1,000 3,000 (large capacity)	20 – 180	2 – 38	40 – 95
Jasper	50 – 2,400	40 – 800 3,000 (large capacity)	20 – 260	2 – 30	60 – 235
Catahoula	50 – 450	50 – 400	20 – 260	2 – 30	100 – 230

CMB=Calcasieu-Mermentau Basin
gpm = gallons per minute
gal/min/ft = gallons per minute per foot

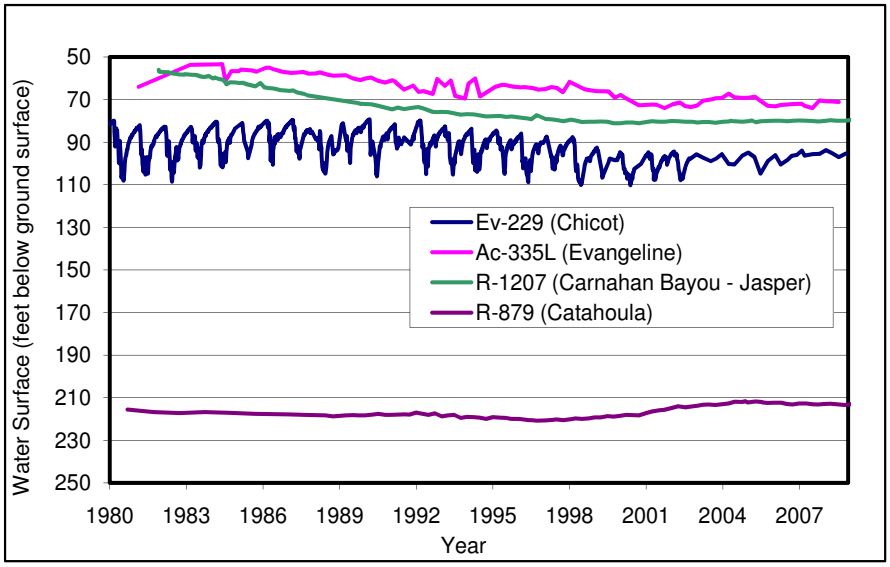


Figure 5. Historical Trends in CMB Groundwater Levels in Representative Wells[15]

The Chicot Aquifer is made up of several smaller aquifer units, including the 200-foot, 500-foot, and 700-foot sands of the Lake Charles area, and the Upper and Lower sands of the Chicot Aquifer, which mainly underlie the rice-growing areas.[27] Historical data from well Ev-229 (**Figure 5**), completed in the Chicot Aquifer in Evangeline Parish, show a groundwater level decline from 1990 to 2000, when groundwater withdrawals for rice irrigation increased substantially. Groundwater levels in the Chicot Aquifer exhibit distinct seasonal fluctuations in response to seasonal precipitation patterns, common in surficial aquifers, and because of increased groundwater use during the rice-growing season.[28] Comparison of additional USGS data from 1996 and 2005 indicates that groundwater levels decreased by about 2 to 4 feet in the CMB during this period, with localized drawdowns of about 12 feet in Arcadia Parish and 8 feet in Jefferson Davis Parish.[29] Both parishes are heavily dependent on groundwater for rice irrigation. In the western portion of the aquifer, groundwater levels have remained stable, partially due to substitution of surface water from the Sabine River Diversion Canal. When the canal was completed in 1982, many industries began using surface water from the canal to supplement groundwater withdrawals. The subsequent decrease in groundwater withdrawals caused groundwater levels to rise by up to 50 feet in some areas.[30]

Historical data from well Ac-335L (**Figure 5**), completed in the Evangeline Aquifer in Acadia Parish, indicate that groundwater levels declined from the late 1980s until the early 2000s, when groundwater withdrawals from the Evangeline Aquifer increased. Heavy pumping from the overlying Chicot Aquifer also directly affects groundwater levels in the Evangeline Aquifer, and historical groundwater level fluctuations observed in the Evangeline Aquifer could have resulted from seasonal pumping from the Chicot Aquifer for rice irrigation.[31] Comparison of additional USGS data from 1996 and 2005 show a groundwater level decline of 2 to 8 feet in the Evangeline Aquifer during this time.[29]

In the CMB, the Jasper Aquifer comprises two aquifer units, the Williamson Creek Aquifer unit and the Carnahan Bayou Aquifer unit. Historical data sets for wells completed in the Williamson Creek Aquifer unit in the CMB have large data gaps and, thus, long-term historical patterns of groundwater level change cannot be observed. However, historical data from wells in the neighboring Sabine River Basin and Atchafalaya-Vermilion Basin (ATVB) indicate that groundwater levels in the Williamson Creek Aquifer declined between 1996 and 2003.[29]

Historical data from wells in the ATVB suggest that groundwater levels have remained stable since 2003.29 Historical data from well R-1207 (**Figure 5**), completed in the Carnahan Bayou Aquifer unit in Rapides Parish, show a groundwater level decline from the early 1980s through the 1990s, followed by stable to slightly increasing groundwater levels from the late 1990s to present.

Historical data from well R-879 (**Figure 5**), completed in the Catahoula Aquifer in Rapides Parish, shows a short period of slight groundwater level decline in the 1990s, followed by groundwater level rise from 2000 to 2004, and stable groundwater levels from 2004 to present. These groundwater level changes loosely follow groundwater level trends in the overlying Carnahan Bayou Aquifer, which is the primary source of recharge for the Catahoula Aquifer.

Groundwater Quality

Groundwater quality issues identified in the 2005 and 2006 LDEQ Baseline Monitoring Program reports are summarized in **Table 10**.[32] No water in any of the tested wells in major CMB aquifers exceeded Federal primary drinking water standards. Water in some wells exceeded secondary drinking water standards for pH, total dissolved solids (TDS), color, chloride, and iron. Lead was detected at concentrations below the primary drinking water standard in two Chicot Aquifer wells. Only one of these wells, well V-535 in Vernon Parish, is located in the CMB.

Table 10. Secondary Drinking Water Standards Exceedences in Major CMB Aquifers

Aquifer	pH	TDS	Color	Iron
Chicot	■	■	■	■
Evangeline	■	■	■	■
Jasper:				
Williamson Creek			■	
Carnahan Bayou	■	■	■	■
Catahoula				■

■ – One or more wells exceeded the secondary standard
CMB=Calcasieu-Mermentau Basin
TDS=total dissolved solids

FLOODING

Flooding in the CMB mainly results from the following three causes:

- Backwater flooding in many basin rivers
- Overbank flooding after intense rainfall events
- Storm surge flooding in coastal areas and inland lakes

Nine of the parishes wholly or partially located in the CMB (Acadia, Allen, Beauregard, Calcasieu, Cameron, Jefferson Davis, Lafayette, Rapides, and Vermilion) have become participants in the National Flood Insurance Program (NFIP), offered through the Federal Emergency Management Agency (FEMA). As part of the NFIP, FEMA prepares Flood Insurance Studies (FIS) and Flood Insurance Rate Maps (FIRM) for rivers and bayous prone to damaging floods; member communities regulate development in floodplains. These studies and maps document flooding problems within parishes and delineate 100-year flood zone maps along major waterways. Some 100-year flood zones are available as digital geographic information system layers; detailed maps and reports can be obtained from FEMA.[33]

USGS estimated flood flow magnitudes for different return periods at streamflow gages throughout the State. Gages within the CMB where significant historical data have been collected are listed in **Table 10**, along with their estimated peak discharges for various recurrence intervals. The USGS analysis is only valid for rural, unaltered waterways. Also included in **Table 10** are peak discharges for major waterways, as reported in the FISs reviewed as part of this basin characterization.

Table 11. Estimated Peak Flow Discharges of CMB Streams[34]

Source	Location		Flood Magnitude (cfs)			
	Gage Number	Name	2-year	10-year	100-year	500-year
USGS	08012000	Bayou Nexpique near Basile, LA	7,820	16,800	35,400	52,800
	08010000	Bayou des Cannes near Eunice, LA	4,730	8,100	11,700	14,100
	08013500	Calcasieu River near Oberlin, LA	14,900	34,800	67,100	94,300
	08014500	Whiskey Chitto Creek near Oberlin, LA	11,900	35,200	81,500	123,900
	08015500	Calcasieu River near Kinder, LA	28,100	64,400	120,300	167,500
	08013000	Calcasieu River near Clenmora, LA	13,000	33,300	67,000	96,400
FIS	Calcasieu River at US Route 190		NA	NA	121,000	NA
	Palmetto Creek at US Route 190		NA	NA	9,950	NA
	Vermilion River downstream from confluence with Kenny Coulee		NA	7,150	8,900	9,900
	Bayou des Cannes at Highway 100		NA	10,200	16,200	21,000
	Bayou Courtableau at Highway 190		NA	15,100	19,100	22,000

cfs=cubic feet per second
CMB=Calcasieu-Mermentau BasinFIS=Flood Insurance Study
LA=Louisiana
NA=not available
USGS=U.S. Geological Survey

ENVIRONMENTAL AND CULTURAL ISSUES

Environmental and cultural resources are important elements of the quality of life in Louisiana, and can affect siting and operation of water resource facilities, as regulated by Federal and State permitting requirements. As shown in **Map 2**, the southern CMB is designated by LDNR as being in the Coastal Zone. Existing environmental issues in the Coastal Zone, such as loss of wetlands and land subsidence, can affect water resources facilities, such as reservoirs.[35]

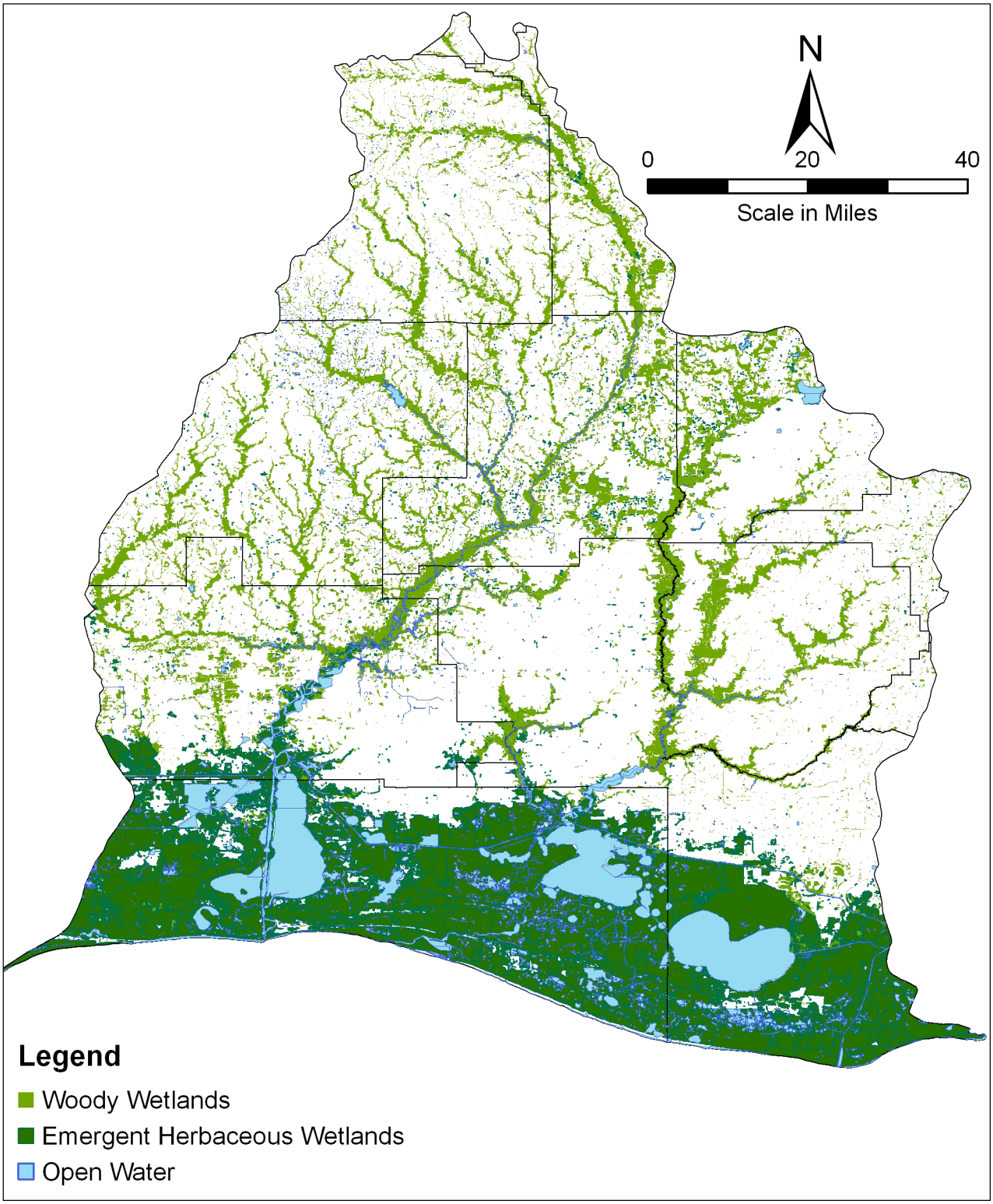
Habitat and Wildlife

The CMB includes parts of the Western Gulf Coastal Plain and the South Central Plains ecoregions.[36] Each ecoregion contains a range of habitats, some of which are associated with species of conservation concern. The Louisiana Wildlife Action Plan prioritizes particular terrestrial habitat types within each ecoregion for conservation.[19]

Terrestrial species Federally listed as threatened or endangered that may reside in the CMB include the Louisiana black bear, red-cockaded woodpecker, brown pelican, piping plover, and American chaff-seed.[37] The Endangered Species Act gives the U.S. Fish and Wildlife Service (USFWS) the authority to protect listed species and their habitat. USFWS has mapped critical habitat areas in the CMB for the piping plover.[38]

Aquatic habitats in the CMB support about 75 species of freshwater fishes, 30 species of mussels, and 16 species of crawfish.[19] State species of concern in the CMB include three crustacean, three freshwater fish, three mussel, and two reptile species. The State regulates aquatic habitat through surface water quality standards in water bodies designated for fish and wildlife propagation.[39] The USFWS has not identified specific surface waters within the CMB important for conservation of species Federally listed as threatened or endangered.[40] The Louisiana Wildlife Action Plan does not prioritize aquatic habitats for conservation.

Wetlands are an important environmental resource throughout the United States, particularly in Louisiana. Alteration of these areas often requires a Federal Section 404 permit through USACE. **Map 8** shows wetlands areas in the CMB. About 13 percent of the CMB's surface area, or 1,050 square miles, is woody wetlands (i.e., areas where forest or shrubland vegetation accounts for a large portion of the cover, and the soil is periodically saturated or inundated) and about 17 percent, or 1,350 square miles, is emergent herbaceous wetlands (i.e., areas where perennial herbaceous vegetation accounts for most of the cover, and the soil is periodically saturated or inundated).[41]



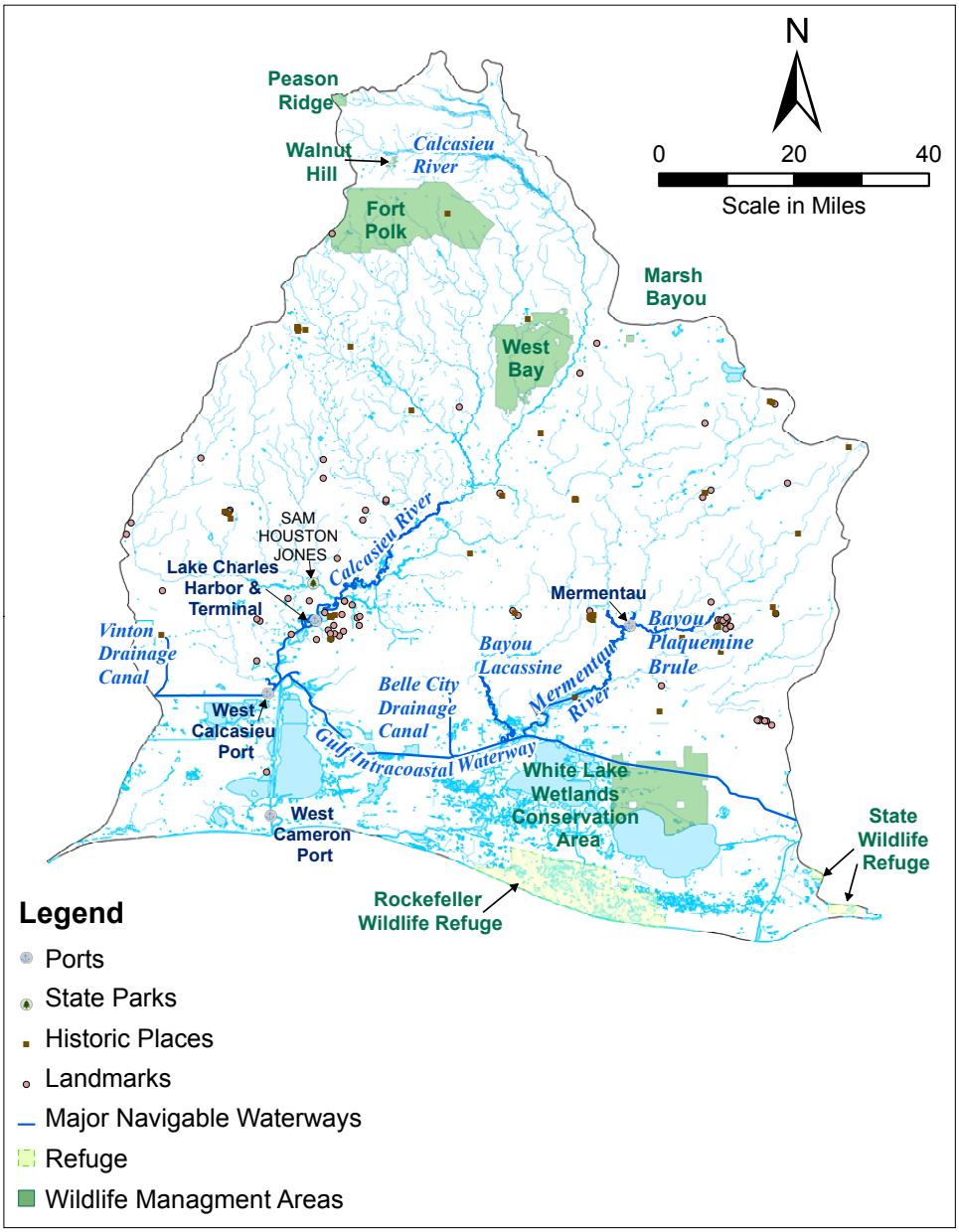
Map 11. Wetlands in the CMB[25]

Cultural Resources

Information on cultural issues and resources is provided by parish-level organizations. Prehistorical (before European colonization) and historical sites are registered with the Louisiana Department of Culture, Recreation, and Tourism (LCRT) and the National Register of Historic Places (NRHP). Featured historic sites in the basin include churches, houses, and bridges.

There are 25 historic points and two historic districts in the CMB, as shown in **Map 12**. Generalized locations of known cultural resources that could affect reservoir siting or operations are available from the NRHP, although no archaeological sites fro the CMB are listed in the NRHP.[42] Additional information is available from the LCRT, Office of Cultural Development, Division of Historic Preservation.

The single Federally recognized tribe in the CMB is the Coushatta Tribe of Louisiana, located in Elton. State-recognized tribes in the CMB include the Four Winds Cherokee Tribe located in Slagle, the Adai Caddo Tribe, and the Clifton Choctaw Tribe.[43] Potentially affected Native American tribes must be notified of any proposed reservoir plans.



Map 12. Cultural and Recreational Resources and Navigable Waterways in the CMB[44]

RECREATION, NAVIGATION, AND HYDROPOWER

Water resources development projects, particularly surface water reservoirs, can provide opportunities for creating and maintaining regional recreation resources. The CMB is widely used for water-oriented recreation: fishing, canoeing, boating, and hunting are popular recreational activities in the area.[45] Eight Wildlife Management Areas in the CMB serve as hunting and camping grounds for the general public. Specific recreational resources of regional value are shown in **Map 8**.

Navigable waterways are important to the State and regional economy, and would have to be maintained by any future water development projects. The seven navigable waterways within the CMB are listed in **Table 11**. Navigation and port facilities are prominent features along the Calcasieu River in the vicinity of Lake Charles.

Table 11. Summary of Navigable Waterways in the CMB

River	Outflow	Navigable Depth (feet)[46]	Navigable Length (miles)
Bayou Lacassine	GIWW	NA	NA
Bayou Plaquemine Brule	Mermentau River	13	16
Belle City Drainage Canal	GIWW	NA	NA
Calcasieu River	Gulf of Mexico	40	90
GIWW	Ttraverses State east to west	12	96
Mermentau River	Gulf of Mexico	12 (above GIWW) 10 (below GIWW)	62 34
Vinton Drainage Canal	GIWW	9	16

CMB=Calcasieu-Mermentau Basin
GIWW=Gulf Intracoastal Waterway
NA=not available

In 1968, the Calcasieu River was modified to provide a 40-foot-deep by 400-foot-wide channel extending from the jetties at the river mouth to Lake Charles. Annual traffic along the Calcasieu River from 1986 through 1995 exceeded 40 million tons. Cargo primarily consisted of crude petroleum, petroleum products, and chemicals. Below Lake Charles, the Calcasieu River serves primarily as access to fishing and hunting areas in adjoining lakes, bayous, wetlands, and the Gulf of Mexico. Hunting and fishing also occurs along the Calcasieu River above Lake Charles; private camps, picnic areas, and commercial recreational facilities are located between Philips Bluff and Lake Charles.[48]

The GIWW is a 1,300-mile-long, man-made canal that runs along the Gulf of Mexico coastline, from Texas's southernmost tip at Brownville to St. Marks, Florida. Primarily used for shipping, the GIWW links all Gulf Coast ports, and provides access from these ports to the national inland waterway system.[49] In Louisiana, the GIWW stretches 306 miles along the Louisiana coastline from the Pearl River to the Sabine River, and is maintained at a depth of 12 feet. In 2006, a total of approximately 84 million tons of cargo was transported through the GIWW in Louisiana.[50]

Navigation improvements along the Mermentau River began in 1952 with construction of control structures in the enlarged channels near Grand Lake (Catfish Point Control Structure) and Schooner Bayou. In 1971, a navigation channel was constructed at the point of entry of the Mermentau River into Lower Mud Lake to the Gulf of Mexico. The Mermentau River – Gulf of Mexico Navigation Channel is 4.6 miles in length. Annual traffic on the Mermentau River from 1986 through 1995 was nearly 1 million tons.[48]

Bayou Plaquemine Brule is a 6-foot-deep by 60-foot-wide channel from its mouth to near Crowley, approximately 19 miles. There is minimal cargo traffic on Bayou Plaquemine Brule.[48]

Four ports are located within the CMB: Lake Charles Harbor and Terminal District, Mermentau River Harbor and Terminal District, West Calcasieu, and West Cameron. The Lake Charles Harbor and Terminal District, encompassing 203 square miles of Calcasieu Parish, is the largest port in the CMB.

Hydropower projects are not present in the CMB. The U.S. Department of Energy has identified several potential sites for microhydropower projects (less than 100 kilowatts) in the CMB, including locations on the Houston, Mermentau, and Calcasieu rivers.[51]

INTERBASIN AND INTERSTATE ISSUES

Interbasin and interstate issues are of less importance in the CMB than in other basins in the State because the CMB does not share a border with any other State and does not receive significant surface water inflow from upstream basins. However, important interbasin and interstate groundwater issues do exist.

The Chicot, Evangeline, and Jasper aquifers extend across the border with Texas. These aquifers (along with the Carrizo-Wilcox Aquifer) are grouped into the Gulf Coast Aquifer System. The Gulf Coast Aquifer System is used for municipal, industrial, and irrigation purposes. Overpumping in the Gulf Coast Aquifer System has led to land subsidence in several counties in Texas. In 2006, the City of Houston used approximately 170 mgd of groundwater. The population of Houston is expected to more than double between 2000 and 2060, and water demand is expected to increase 27 percent by 2060. As a result, groundwater availability models estimate that groundwater supply will decrease 32 percent between 2010 and 2060. The Texas Water Development Board has developed a water management plan with several strategies to address future needs. However, groundwater will account for 9 percent of the total projected volume to be provided by all recommended water management strategies on a statewide basis in 2060.[52] Given the groundwater level decline in the Gulf Coast Aquifer System, and projected water demand increase due to population growth, further investigations into the effects of Houston-area groundwater use on the portion of the Gulf Coast Aquifer System underlying Louisiana may be warranted.

SUMMARY OF WATER RESOURCES NEEDS

To identify and prioritize statewide water resources issues, a needs assessment of each of the nine major surface water basins within Louisiana was performed. Because the needs assessment provides the foundation for developing reservoir priority evaluation criteria, it focuses on needs that can be addressed by surface water reservoirs. At the same time, the integrated nature of water resources management requires evaluating issues that could not necessarily be solved, but could be affected, by a reservoir.

Based on the existing compiled information, eight categories of State water resources needs that could be addressed or affected by construction of surface water reservoirs were identified and evaluated. Evaluation criteria were developed for each category to allow interbasin comparison of the needs. To maintain objectivity in the evaluation process, evaluation criteria were developed based on factors that could be evaluated as quantitatively as possible across all basins. High, medium, and low levels of current need were defined based on differences in these factors between basins. Future needs in each basin were assessed by determining whether each current need is increasing, constant, or decreasing. The evaluation criteria are described in detail in the main body of the Statewide Perspective on Water Management Report, to which this basin characterization is an appendix.

The assessed needs in the CMB are summarized below. Details of the assessed needs for all nine major Louisiana surface water basins, as well as a comparison of statewide needs by issue, are presented in the Statewide Perspective on Water Management Report.

Assessed needs in the CMB are shown in **Table 13**, and are discussed below in general order of need, from high-level needs (colored red in **Table 13**) to low-level needs (colored green in **Table 13**). No low-level needs were identified in the CMB.

Table 13. Assessed Water Resources Needs in the ORB

Category	Current	Future
Surface Water Supply	medium	–
Surface Water Quality	medium	↑
Groundwater Supply	high	–
Groundwater Quality	high	–
Flood Control	medium	–
Environmental Protection and Enhancement	high	↑
Recreation	medium	↑
Navigation	high	–

CMB = Calcasieu-Mermentau Basin
Red = high-level need; Yellow=medium-level need; Green=low-level need
↑ = increasing importance
– = same importance
↓ = decreasing importance

Because groundwater is heavily used in the basin and groundwater levels show long-term declines, groundwater supply was identified as a high-level need. Declining water levels in portions of the Chicot, Evangeline, and Jasper aquifers threaten the sustainability of agricultural and potable water supplies for parts of the CMB. Groundwater issues are complicated by the fact that aquifers extend into Texas and have experienced historical drawdown. Consequently, water development and management activities in one State can affect the other. Overpumping of groundwater in the basin has also led to saltwater intrusion, making groundwater quality another high-level need in the basin.

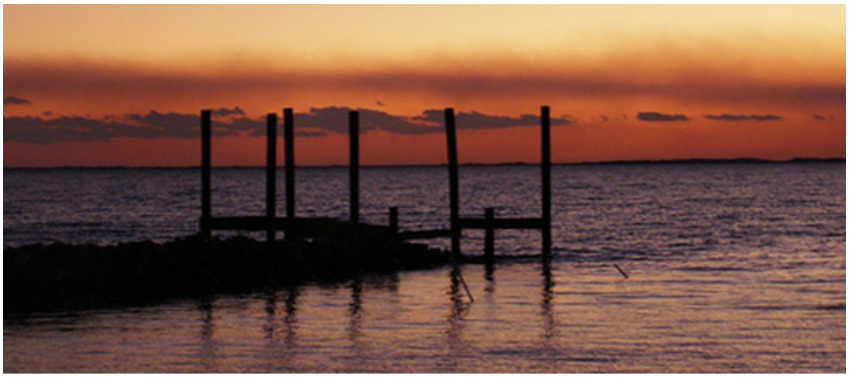
Environmental protection and enhancement was ranked as a high-level need with increasing importance in the future. Many environmental issues constrain future development of additional water supplies, including widespread wetland and naturally vegetated areas covering over 50 percent of the basin; substantial areas considered Prime Farmland by NRCS; and nearly 800 miles of State-designated Natural and Scenic Rivers.

Navigation was ranked as a high-level need. There are approximately 300 miles of navigable waterways and 4 ports in the CMB. Despite a cargo throughput of 60 million tons in 2006, the Port of Lake Charles has received only 50 percent of the requested funding from 2003 to 2009 for dredging and maintenance of the Calcasieu River. In 2008, it was reported that the river was 2 feet shallower than its required depth. Recently, the U.S. Congress allocated the remaining 50 percent of requested funding from 2003 – 2009. However, the 2010 Federal budget submitted to Congress contains only $17.9 million of the $40 million required to maintain the river properly. Waterways in the CMB remain vulnerable to rapid sedimentation because of hurricanes.

Surface water quality was ranked as a medium-level need with increasing importance in the future. A majority of the major surface waters in the CMB are considered impaired by the State, although no drinking water impairments currently exist. Common constituents causing impairment are dissolved oxygen, nutrients, and turbidity. Heavy industrial uses in the basin also increase the risk of water quality problems from spills or untreated releases. Additionally, saltwater intrusion has occurred in streams and impoundments that were previously freshwater.

Flood control was identified as a medium-level need. Widespread areas of potential flooding are present in the CMB, and one major population center, Lake Charles, is exposed to flood risk. Flood control and floodplain management measures are needed to protect existing land uses and minimize future flood damages. In the CMB, flows tend to be conveyed in the largest straightened channels, and the resulting siltation and sedimentation of natural channels poses a flooding risk.

Recreation was ranked as a medium-level need. Four major water bodies and one wildlife refuge are present in the CMB. The basin's increasing population suggests that the importance of recreational opportunities will also increase in the future.



ABBREVIATIONS

°F	degrees Fahrenheit
7Q10	7-day low flow with a recurrence interval of 10 years
ATVB	Atchafalaya-Teche-Vermilion Basin
cfs	cubic feet per second
DOTD	Louisiana Department of Transportation and Development
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
GIWW	Gulf Intracoastal Waterway
gpcd	gallons per capita per day
LCRT	Louisiana Department of Culture, Recreation, and Tourism
LDEQ	Louisianan Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
mgd	million gallons per day
NFIP	National Flood Insurance Program
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWIS	National Water Information System
State	State of Louisiana
TDS	total dissolved solids
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

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